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THE PLANT DISEASE BULLETIN

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The Plant Disease Survey

SUPPLEMENT 4

Summary of Plant Diseases in the United States in 1918 – Diseases of Cereal and Forage Crops

June 20, 1919

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

SUMMARY OF PLANT DISEASES IN THE UNITED STATES IN 1918.

IV. DISEASES OF CEREAL AND FORAGE CROPS.

Prepared by
R. J. Haskell.

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DISEASES OF CEREAL CROPS.

WHEAT

Bunt caused by Tilletia laevis Kuhn and T. tritici (Bjerk.) Wint.

Bunt occurred rather widely over the United States last year as usual. The extensive survey for cereal diseases conducted by the Office of Cereal Investigations of the Department of Agriculture has helped greatly in determining the geographical distribution of and losses occasioned by bunt and cereal diseases in general. The results of the cereal survey have been made available for this report. The following table shows the average percentage of bunt for each state where surveys were made and the total number of fields inspected in the state.

Table XV. Average percentages of bunt found in the various states by field men of the Office of Cereal Investigations.

State	Production: 1918 Bushels (000 omitted)	No. of fields inspected	Average percent bunt	State	Production: 1918 Bushels (000 omitted)	No. of fields inspected	Average percent bunt
Me.	506	67	.5	Mo.	53,154	817	1.6
N.H.	--	83	t	N.D.	101,010	203	1.5
Vt.	396	161	t	S.D.	71,305	22	2.1
Mass.	--	12	t	Nebr.	43,141	237	6.6
R.I.	--	1	0	Kans.	102,008	197	1.2
Conn.	--	76	.1	Ky.	12,129	211	.2
N.Y.	7,840	237	t	Tenn.	7,500	244	2.
N.J.	1,700	73	.7	Ala.	1,330	225	1.9
Pa.	24,718	364	.2	Miss.	495	169	1.3
Del.	1,729	--	-	La.	--	17	t
Md.	11,346	95	.2	Texas	8,920	190	t
Va.	15,600	323	2.7	Okla.	32,899	167	.4
W.Va.	4,942	144	.7	Ark.	3,048	157	2.2
N.C.	7,105	249	.7	Mont.	25,434	208	2.4
S.C.	2,255	38	.5	Wyo.	6,600	41	1.
Ga.	3,631	133	1.3	Colo.	13,335	77	2.4
Fla.	--	--	-	N.Mex.	3,334	--	-
Ohio	43,547	348	.9	Ariz.	988	--	-
Ind.	49,427	158	2.7	Utah	6,464	--	-
Ill.	60,991	51	1.8	Nev.	1,070	--	-
Mich.	10,716	228	3.6	Idaho	18,043	--	-
Wis.	9,837	251	7	Wash.	26,429	806	2.5
Minn.	79,710	789	3.5	Ore.	15,228	--	-
Iowa	19,650	435	1.1	Calif.	7,590	341	7.5

In the crop loss estimates of the Plant Disease Survey for 1918 (Plant Disease Bulletin Supplement 6,1919.) these figures have been taken as a basis for estimates but they have been altered somewhat in ways that are believed to represent more actually the true conditions. The estimate of the Plant Disease Survey for loss from bunt in the United States in 1918 is 2% or 19,063,000 bushels, 2,931,000 bushels less than in the year 1917. This much reduction in the amount of bunt from one year to the next could easily be brought about by the seed treatment campaign conducted in 1917-1918.

As will be seen from the above table the greatest average percentages of bunt occurred in California, Nebraska, Michigan, Minnesota, etc. in order of importance. The greatest loss of wheat, however, occurred in Minnesota, Nebraska, North Dakota and South Dakota where the production is large and bunt common.

In the spring wheat states such as the Dakotas and Minnesota, the disease was said to be more abundant on spring wheat than on winter wheat. It was reported as being more common than usual in Michigan and Minnesota but less than normal in Oregon.

At the meeting of cereal pathologists at La Fayette, Indiana, June 19-21, 1918, considerable interest was shown in the geographical distribution of the two species of Tilletia causing bunt of wheat. A. A. Potter was

At the meeting of cereal pathologists at La Fayette, Indiana, June 19-21, 1918, considerable interest was shown in the geographical distribution of the two species of Tilletia causing bunt of wheat. A. A. Potter was appointed leader of the project of obtaining more definite information on the matter, the work to be undertaken in cooperation with the Plant Disease Survey and the War Emergency Board of American Pathologists. Letters and blanks outlining the project were distributed widely to plant pathologists and botanists both in the United States and Canada through the organization of the Plant Disease Survey.

Replies were received from 21 states and provinces. The summary of results is given in Table XVI.

Table XVI. Summary of Determinations of Tilletia tritici and T. laevis on Wheat as shown by questionnaires of plant pathologists, 1918. All determinations were based on microscopic examination.

State where collected	Tilletia tritici					Tilletia laevis			
	State reporting	Locality where collected	Date of collection	Collector	Identified by	Locality where collected	Date of collection	Collector	Identified by
Mass.	Mass.	----	---	----	----	Amherst	7-18-18	Anderson	Wheeler & Pierson.
N. Y.	N. Y.	----	---	----	----	Ithaca	6-17-15	Chupp	Smiley.
						Ithaca	6-19-15	Barrus	Smiley.
						Ithaca	7-26-15	Barrus	Smiley.
						Ithaca	10-21-15	Barrus	Smiley.
						W. Junius	7-9-16	Whetzel & Jackson	Smiley.
						Ithaca	1903	Class	Smiley.
Pa.	Pa.	----	---	----	----	Lycoming Co.	7-17-14	Bell	Voris.
Va.	Va	----	---	----	----	Blacksburg	6-20-02	Wood	Fromme.
						Blacksburg	6-25-99	Scott	Fromme.
						Blacksburg	6-23-91	Alwood	Fromme.
Ky.[1]	Vt.	----	---	----	----	Lexington	6-24-90	Garman	Lutman.
	Mass.					Lexington	6-24-90	Garman	Wheeler & Pierson.
	N.Y.					Lexington	6-24-90	Garman	Smiley.
	N.J.					Lexington	6-24-90	Garman	Macpherson.
	Ind.					Lexington	6-24-90	Garman	Mains.
	Minn.					Lexington	6-24-90	Garman	MacInnes.
	Oreg.					Lexington	6-24-90	Garman	Rose.
	Ont.					Lexington	6-24-90	Garman	Faull. & Cook.
N. C.	N. Y.	----	---	----	----	Fairview	7-2-07	Stevens	Smiley.

		Tilletia tritici				Tilletia laevis			
Texas	Minn.	----	---	----	----	Greenville	6-1-18	Piemeisel	MacInnes.
Okla.	Okla.	Stillwater	6-10-18	Learn	Clifton				
	Conn.					Stillwater	6-10-18	Learn	Clinton.
	Conn.					Custer	6-2-15	Learn	Clinton.
Ind.	Ind.	New Carlisle	7-10-17	Osner	Mains				
Mass.						----	1889	Arthur	Wheeler &
									Pierson.
Ind.	N. J.					Haw Patch	7-17-89	----	Macpherson.
	Ind.					Haw Patch	7-17-89	----	Mains.
	Minn.					Haw Patch	1889	----	MacInnes.
	Iowa					Haw Patch	1889	----	Durrell.
	Ind.					Frankton	7-5-09	Feight	Mains.
	Ind.					Jonesboro	7-30-10	Neill &	Mains.
								Van Valer	
	Ind.					Fort Wayne	7-21-10	Bash & Co.	Mains.
	Ind.					New Carlisle	7-10-17	Osner	Mains.
Ill.	Vt. 2	----	---	----	----	Carbondale	7-28-92	Graham	Lutman.
	Mass.2					Carbondale	7-28-92	Graham	Wheeler &
									Pierson.
	Conn.2					Carbondale	7-28-92	Graham	Clinton
	N. J.2					Carbondale	7-28-92	Graham	Macpherson.
	Ind.2					Carbondale	7-28-92	Graham	Mains.
	Ont.2					Carbondale	7-28-92	Graham	Marj. Cook.
	Conn.					Urbana	7-6-92	Clinton	Clinton.
	Conn.					Urbana	6-30-92	Clinton	Clinton.
Mich.3	Vt.	----	---	----	----	East Lansing	1894	Beal	Lutman.
	Mass.					East Lansing	1894	Beal	Wheeler &
									Pierson.
	Conn.					East Lansing	1894	Beal	Clinton.
	N. Y.					East Lansing	1894	Beal	Macpherson.
	Ind.					East Lansing	1894	Beal	Mains.
	Ont.					East Lansing	1894	Beal	Faull & Cook.
Wis.	Wis.	3 Collections			Vaughan	19 Collections			Vaughan.
	Iowa					LaCrosse	1892	Pammel	Durrell.
						LaCrosse	1883	Pammel	Durrell.
Minn.	Minn.	St. Paul	1907	Freeman	MacInnes	St. Paul	1907	Freeman	MacInnes.
	Minn.	St. Paul	1909	Freeman	MacInnes	St. Paul	1908	Freeman	MacInnes.

		Tilletia tritici				Tilletia laevis			
Minn.	Minn.	St. Paul	1907	----	MacInnes	St. Paul	1909	Freeman	MacInnes.

	Tilletia tritici					Tilletia laevis			
Minn.	Minn.	St. Paul	1907	----	MacInnes	St. Paul	1909	Freeman	MacInnes.
	Minn.	Koochiching Co.	8-2-18	Gillis	MacInnes	St. Paul	1907	----	MacInnes.
	Minn.	Beltrami Co.	7-31-18	Gillis	MacInnes	Crookston	1913	----	MacInnes.
	Minn.	Beltrami Co.	7-30-18	Gillis	MacInnes	Red River	1908	Smith	MacInnes.
	Minn.	Beltrami Co.	7-29-18	Gillis	MacInnes	Two Harbors	1916	Stakman	MacInnes.
	Minn.	Todd Co.	7-27-18	Gillis	MacInnes	Hastings	1915	Stakman	MacInnes.
	Minn.	Red Lake Falls	7-29-18	Plagge	MacInnes	Audubon	1915	Stakman	MacInnes.
	Minn.	Mahnomen	7-27-18	Bakke	MacInnes	Farmington	--	Borthwick	MacInnes.
	Minn.	Wadena	7-25-18	Tucker	MacInnes	Pine City	1918	Fradenburg	Thurston.
	Minn.	Park Rapids	7-24-18	Tucker	MacInnes	29 Collections	1918	Cereal Scouts	MacInnes.
		Grand Rapids	8-6-18	Newhall	MacInnes				
Iowa	Mass.	----	---			Decorah	8 - 1884	Holway	Wheeler & Pierson.
	N. J.					Decorah	8 - 1884	Holway	Macpherson.
	Ind.					Decorah	8-1-84	----	Mains.
						Central	'79-'80	Roberts	Mains.
	Minn.					Decorah	8 - 1884	Holway	Macpherson.
	Neb.					Decorah	8 - 1884	Holway	Thurston.
	Iowa					Story Co.	----	Stewart	Durrell.
						Monona Co.	1918	Martin	Durrell.
						Monona Co.	1918	Martin	Durrell.
						----	1904	Baker	Durrell.
Mo.	No.	Single specimen	---	----	----	46 counties	1918	Cereal men	Johann.
	Iowa					Mayville	1918	Bakke	Durrell.
N. Dak.	Conn.	Kulm	9 - 1909	Brenckle	Clinton	Kulm	9 - 1908	Brenckle	Clinton.
	Pa. 4	Kulm	10-2-10	Brenckle	Kirk	Kulm	10-20-10	Brenckle	Voris.
	Ind. 4	Kulm	10-2-10	Brenckle	Mains	Kulm*	10-20-10	Brenckle	Mains.
	Oreg. 4	Kulm	10-2-10	Brenckle	Rose	Kulm*	10-20-10	----	Rose.
	Minn.					Valley City	8-24-18	Piemeisel	MacInnes.
						Dickinson*	1915	Piemeisel	MacInnes.
	Iowa	Pingree	1912	Campbell	Durrell				
S. Dak.	Vt. 5	Newell	7-11-12	Carr	Lutman				
	Mass.	Newell 5	7-11-12	Carr	Wheeler & Pierson	Eureka	10-1895	Griffiths	Wheeler & Pierson.
						Scatterwood	7 - 1896	Griffiths	W. & P.
	Conn.					Brookings	1905	Wheeler	Clinton.
	Conn.					Flanders	8 - 1892	Griffiths	Clinton.
	N. J.					Scatterwood	10-1895	Griffiths	Macpherson.
	Ind. 5	Newell	7-11-12	Carr	Mains	Newell*	7-11-12	Carr	Mains.

	Tilletia tritici					Tilletia laevis			
	Iowa					Eureka	1895	Griffiths.	Durrell.
	Ore. 5	Newell.°	7-11-12	Carr.	Rose.	Scatterwood.	7-1896	-----	Rose.
Nebr.	N. Y.					Champion.	9-1-09	Roller.	Smiley.
Kans.	Vt. 6					Rockport.	7-1894	Barth.	Lutman.
	Mass. 6					Rockport.	7-1894	Barth.	Wheeler & Pierson.
	Vt.					Stockton.	8-8-10	Barth.	Lutman.
	Mass.					Stockton.	8-8-10	Barth.	W. & P.
	Oreg.					Stockton.+	8-8-10	Barth.	Rose.
	N.Y.	Rockport. 6	7-1894	Barth.	Smiley.	Stockton.	8-8-10	Barth.	Smiley.
Kans.	Oreg. 6					Rockport.+	7-1894	Barth.	Rose.
	N.J. 6					Rockport.	7-1894	Barth.	Macpherson.
	Nebr. 6					Rockport.	7-1894	Barth.	Thurston.
	Ind. 6					Rockport.+	7-1894	Barth.	Mains.
	7					Rockport.	7-1894	Barth.	Mains.
	Minn. 6					Rockport.	7-1894	Barth.	MacInnes.
	Iowa					Greely Co.	1907	Anderson.	Durrell.
	Nebr.					Sidney.	11-1907	----	Thurston.
						Nicator.	11-1907	----	Thurston.
	Canada	Stockton	8-1910	Barth.	Faull & Cook.	Rockport.	7-1894	Barth.	Faull & Cook.
Mont.	N. Y.					Judith Basin.	8-14-08	Shantz.	Smiley.
Wyo.	Mass.					Ft. McKinney.	8-1898	Williams & Griffiths.	Wheeler & Pierson.
	N.J.					Ft. McKinney.	8-1898	Wms.&Grif.	Macpherson.
	Iowa					Ft. McKinney.	8-1898	Wms.&Grif.	Durrell.
	Oreg.					Ft. McKinney.	8-1898	Wms.&Grif.	Rose.
N.Mex.	N.Mex.	Bernalillo Co.	8-24-18	Pacheco.	Werkenthin.	Dona Ana.	5-18-18	Werkenthin.	Werkenthin.
						Roswell.	7-28-18	Yeaw.	Werkenthin.
						Alamagordo.	7-29-18	Beaty.	Werkenthin.
						Hillsboro.	8-12-18	Wilson.	Werkenthin.
						Gallup.	8-27-18	Taylor.	Werkenthin.
Utah.	Wash.	Wayne Co.			Zundel.				
	N.Y.					Ephriam.	1909	Jensen.	Smiley.
	Wash.					Beaver Co.(2)	1918	---	Zundel.
		Iron Co. (1)			Zundel.	Iron Co. (1)	1918	---	Zundel.
						Kane Co. (1)	1918	---	Zundel.
						SanJuan Co.(1)	1918	---	Zundel.
	Oreg.					Salt Lake City	1918	Hungerford	Rose.

	Tilletia tritici					Tilletia laevis				
Idaho	Idaho	Boundary Co.(1)			Zundel	Bingham Co.(1)	1918	----		Zundel.
		Lewis Co.(3)			Zundel	Gooding Co. (2)	1918	----		Zundel.
		Power Co. (5)			Zundel	Fremont Co. (1)	1918	----		Zundel.
		Gooding Co. (3)			Zundel	Minidoka Co. (1)	1918	----		Zundel.
		Minidoka Co. (2)			Zundel	Bonneville Co.(1)	1918	----		Zundel.
		Canyon Co. (2)			Zundel	Canyon Co. (1)	1918	----		Zundel.
		Winchester	1918	Woolman	Rose	Jefferson Co.(1)	1918	----		Zundel.
		Ilo	1918	Woolman	Rose					
		Pocatello	1918	Woolman	Rose					
	Oreg.					Pocatello	1918	Woolman		Rose.
Wash.	Wash.	Whitman Co. (70)			Zundel	Thurston Co.(2)	1918	----		Zundel.
		Asotin Co.(25)			Zundel					
		Walla Walla (7)			Zundel					
Wash.	Wash.	Stevens Co. (6)			Zundel					
		Spokane Co. (3)			Zundel					
		Yakima Co. (4)			Zundel					
		Kittitas Co. (1)			Zundel					
		Thurston Co. (4)			Zundel					
		Island Co. (5)			Zundel					
		Okanogan Co. (3)			Zundel					
		Douglas Co. (1)			Zundel					
		Klickitat Co.(7)			Zundel					
		Chelan Co. (3)			Zundel					
	N. J.									
	Conn.	Ritzville	6 - 1902	Griffiths & Cotton	Clinton	----	1916	Heald		Macpherson.
	N. Y.	----	11-1906	Lawrence	Smiley					
			11- 1916	Heald	Macpherson					
	Pa.	Near Garfield	7-20-10	Bates	Voris					
	Minn.	Pullman	1911	---	MacInnes					
		----	---	West	MacInnes					
Oreg.	Oreg.	Monroe	1918	---	Rose	27 towns		Cereal Disease Survey		Rose
		Corvallis	1918	Woodham & Young						
		Amity	1918	W. & Y.	Rose					
		Salem	1918	W. & Y.	Rose					
		Newberg	1918	W. & Y.	Rose					
		Dayton	1918	W. & Y.	Rose					
		Sheridan	1918	W. & Y.	Rose					

			Tilletia tritici			Tilletia laevis		
Oreg.	Oreg.	Monmouth	1918	Woodham & Young	Rose			
		Independence	1918	W. & Y.	Rose			
		McMinnville	1918	W. & Y.	Rose			
		Canby	1918	Bell	Rose			
		Silverton	1918	Bell	Rose			
		Scio	1918	Bell	Rose			
		Gresham	1918	W. & Y.	Rose			
		Oregon City	1918	W. & Y.	Rose			
		Estacada	1918	W. & Y.	Rose			
		Tallman	1918	W. & Y.	Rose			
		Forest Grove	1918	W. & Y.	Rose			
		Farmington	1918	W. & Y.	Rose			
		Wilksboro	1918	W. & Y.	Rose			
		Gaston	1918	W. & Y.	Rose			
		Hillsboro	1918	W. & Y.	Rose			
		Medford	1918	Woolman	Rose			
		Klamath Falls	1918	Woolman	Rose			
		Condon	1918	Bell & Kerns	Rose			
		Clem	1918	B. & K.	Rose			
		Harnes	1918	B. & K.	Rose			
		Lagrande	1918	B. & K.	Rose			
		Hot Lake	1918	B. & K.	Rose			
		Baker	1918	B. & K.	Rose			
		Enterprise	1918	B. & K.	Rose			
		Union	1918	B. & K.	Rose			
		North Powder	1918	B. & K.	Rose			
		Imtler	1918	B. & K.	Rose			
		Summerville	1918	B. & K.	Rose			
	Ind.	Ashland	9-1910	Jackson	Mains			
		Plush	10-7-12	Chahtrand	Mains			
	Oreg.	Plush	10-7-12	Chahtrand	Rose			
		Ashland	9-1-10	Jackson	Rose			
Sask.	Man.	Indian Head	8-1917	Cowan	Fraser			
		Indian Head	8-29-18	Fraser	Fraser			
		Saskatoon	9-2-18	Fraser	Fraser			
		Saskatoon (Many)	1916-17	Thompson	Thompson			
		Saskatoon	1918	Bracken	Thompson			

	Tilletia tritici						Tilletia laevis		
N. S.		Picton	9 - 1912	Fraser	Fraser				
Man.	Man.	Brandon	8 - 1918	Fraser	Fraser	Winnipeg	8 - 1917	Fraser	Fraser.
						Brandon	8 - 1918	Fraser	Fraser.
Albt.	Man.	Stony Plains	9-5-18	Fraser	Fraser	Scott			
		Edmonton	9-4-18	Fraser	Fraser				
		Scott	8 - 1916	Cowan	Fraser				
						Scott	8 - 1916	Cowan	Fraser.
N. B.	Ont.	Tobique River	1905	Faull	M. Cook				
Ont.	Ont.	Bond Lake	7 - 1907	Faull	Faull	Puslinch	7-24-15	Dearness	Faull & Cook
	Vt.					Puslinch	7-24-15	Dearness	Lutman.
	Mass.					Puslinch	7-24-15	Dearness	W. & P.
	N. Y.					Puslinch	7-24-15	Dearness	Smiley.
	Pa.					Puslinch	7-24-15	Dearness	Kirk
	Ind.					Puslinch	7-24-15	Dearness	Mains.
						Guelph	9-30-97	Hume	Mains.
Saxony	N. J.		7-28-01	Sydow	McPherson				
	Ind.8		1883 & 6	Krieger	Mains				
	Minn.8		1883-86	Krieger	MacInnes				
	Minn.		7-29-01	Sydow	MacInnes				
	Ont.		1901	Sydow	F. & Cook				
Germany	N. J.					Moravia	8 - 1878	Niessl.	Macpherson.
	Minn.		7 - 1887	Sydow	MacInnes	Moravia	1879	Niessl	MacInnes.
	Ont.					Holstein	1879	Hennings	MacInnes.
						Holstein	1879	Hennings	F. & Cook.
Hungary	N. J.	Nossen	8 - 1883	Krieger	Macpherson	Gahling	6 - 1882	Linhart	Macpherson.
		Rangsdorf	1887	Sydow	Macpherson	Holstein, Halle	1879	Paznhke	Macpherson.
	Ind. 9						1882	Linhart	Mains.
	Ont.					Bohemia	7 - 1910	Bubak	Faull & Cook.
Italy	Ind.	Mongardino	1890	Bolognini					
	Oreg.10					Pavia+	1890	Bolonini	Rose

1. Seymour & Earle Econ. Fungi, 79.
2. Seymour & Earle Econ. Fungi. Suppl. C 51.
3. Seymour & Earle Econ. Fungi. Suppl. C 50.
4. Brenkle Fungi Dakotaensis, 132.
5. Barth. Fung. Col. 3883.
6. Ell. & Ev. Fung. Col. 647.

7. Ell. & Ev. N. Am. Fungi, 3236
8. Kreiger, Fungi Sax. 201.
9. Linhart Fungi Hung. 10.
10. Briosi & Cavara, 155.

Notes: a. Practically all bunt collected in western Canada is T. tritici. The collections of T. laevis consisted of only a few heads except Winnipeg collection of 1917.

b. In several collections of Tilletia made by J. H. Faull in Alberta and Saskatchewan in 1906 both T. laevis and T. tritici were found.

c. Numbers in parenthesis after places of collection indicate number of collections.

d. The following symbols have been used in the preceding tabulation:

* = Mixed with T. tritici
\+ = Distributed as T. tritici
° = Distributed as T. laevis (foetens).
x = Mixed with T. laevis.

Table XVII. Numbers of individual collections of Tilletia tritici and Tilletia laevis on wheat as shown in reports of collaborators in 1918. This is essentially a summary of table XVI.

State	Number of Collections		State	Number of Collections	
	T. laevis	T. tritici		T. laevis	T. tritici
Me.	0	0	Ark.	-	-
N. H.	-	-	Ohio.	-	-
Vt.	0	0	Ind.	7	1
Mass.	1	0	Ill.	3	0
R. I.	-	-	Mich.	6	6
Conn.	-	-	Wisc.	21	3
N. Y.	6	0	Minn.	39	13
N. J.	-	-	Iowa	5	0
Pa.	1	0	Mo.	46	1
Del.	-	-	N. Dak.	4	1
Md.	-	-	S. Dak.	6	1
Va.	3	0	Neb.	1	0
W. Va.	-	-	Kans.	5	1
Ky.	1	0	Mont.	1	0
Tenn.	-	-	Wyo.	1	0
N. C.	1	0	Colo.	-	-
S. C.	-	-	N. Mex.	5	1
Ga.	-	-	Ariz.	-	-
Fla.	-	-	Utah	7	2
Ala.	-	-	Nev.	-	-
Miss.	-	-	Idaho	9	19
La.	-	-	Wash.	3	133
Texas	1	0	Oreg.	27	39
Okla.	2	1	Calif.	-	-

Loose smut caused by Ustilago tritici (Pers.) Jens.

Loose smut occurred widely over the country. In the east it was much more frequently found than bunt and in a number of states caused a greater loss than that disease. According to the results of the cereal survey and reports of collaborators, loose smut seems to have been most abundant in an area comprising the coastal plain region of South Carolina, North Carolina and Virginia, and also Maryland. It was also severe, although less so, in the states of New Jersey, Pennsylvania, West Virginia, Ohio, Indiana, Illinois, Missouri and parts of Arkansas and Tennessee. It is significant to note that in some of the more northern states such as Michigan, Wisconsin and Minnesota the disease was said to be more abundant in the southern portions than in the northern. In Michigan it is mentioned that there seemed to be a relation between the prevalence of loose smut and the amount of winter-killing, the disease being more prevalent in the areas or fields of least winter-killing.

The losses from loose smut in 1918 have been estimated for the United States by the Plant Disease Survey as follows: (See also Plant Disease Bulletin Supplement VI, 1919.).

Table XVIII. Estimated percentages of loose smut by states, 1918.

State	Percent	State	Percent	State	Percent
Me.	.7	Fla.	-	Miss.	1.4
N. H.	.7	Ohio	1.9	La.	t
Vt.	.8	Ind.	2.4	Texas	.7
Mass.	.4	Ill.	1.5	Okla.	.6
R. I.	.5	Mich.	.6	Ark.	5.
Conn.	1.	Wis.	t	Mont.	2.
N. Y.	.5	Minn.	.5	Wyo.	t
N. J.	1.4	Iowa	.4	Colo.	.2
Pa.	1.7	Mo.	1.1	N. Mex.	t
Del.	-	N. D.	.5	Ariz.	t
Md.	4.	S. D.	1.5	Utah	-
Va.	3.	Nebr.	.5	Nev.	t
W. Va.	2.	Kans.	.4	Idaho	-
N. C.	2.7	Ky.	.7	Wash.	t
S. C.	1.8	Tenn.	1.	Ore.	t
Ga.	4.	Ala.	1.	Calif.	t

Estimated bushels loss, United States, 9,368,000.

The above figures show that loose smut is of considerable economic importance at least in certain parts of the country. It also appears from other information at hand that very little is being done by farmers to control the disease.

Stem rust caused by Puccinia graminis Pers.

Stem rust occurred widely over the grain producing area, but only in a few local instances did it cause any serious loss. The weather con-

ditions were fairly favorable for rust in parts of the spring wheat region, but the early harvest coupled with the late appearance of the rust resulted for the most part in the wheat escaping the disease. The following figures give the average percentages of affected sheath and stem area by states according to the observation of scouts of the Cereal Office.

Table XIX. Average percentages of stem rust by states as determined by field men of U. S. Dept. of Agriculture 1918. Figures represent percentages of affected area according to the standard scale for estimating rusts.

State	No. fields examined	% rust	State	No. fields examined	% rust	State	No. fields examined	% rust
Me.	67	t	Ga.	133	1.3	Ky.	211	7.5
N. H.	83	t	Ohio	348	8.6	Tenn.	244	6.6
Vt.	161	1	Ind.	158	2.3	Ala.	225	t
Mass.	12	t	Ill.	51	2.9	Miss.	169	2.5
Conn.	76	t	Mich.	228	15.9	La.	17	0
N. Y.	237	.7	Wis.	251	23.8	Texas	190	.9
N. J.	73	.5	Minn.	789	5.	Okla.	167	1.9
Pa.	364	.8	Iowa	435	3.8	Ark.	157	-
Md.	95	t	Mo.	817	1.	Mont.	208	0
Va.	323	2.	N. D.	203	-	Wyo.	41	t
W. Va.	144	1.8	S. D.	22	39.6	Colo.	77	-
N. C.	249	.7	Nebr.	237	6.2	Wash.	806	t
S. C.	38	4.6	Kans.	197	2.4	Calif.	341	1

It will be seen that the percentages of rust were rather high in Michigan, Wisconsin and South Dakota. It was also epidemic in parts of Ohio, causing some loss in certain southwestern counties, but the average for the state is not high. For the country as a whole, 1918 may be considered an off year for stem rust.

Barberry eradication progressed very satisfactorily throughout the season. The work was pushed enthusiastically in a large number of the northern cereal states with the result that the majority of barberry bushes were eliminated in most states. The campaign threw much light on the wide range of the common barberry and the relation that it bears to the cereal rust. Hundreds of instances were observed showing that the presence of infected barberry bushes were responsible for outbreaks of rust on grains.

Leaf rust caused by *Puccinia triticina* Erik.

During the season of 1918 the Plant Disease Survey gathered considerable information on the occurrence of leaf rusts. Six men obtained field data in most of the principal eastern wheat states, starting in the South and working northward with the season. In addition to these results, the field men from the Office of Cereal Investigations engaged in seed treatment and survey work secured extensive estimates of percentages of leaf rust in many states.

Last year, as usual, leaf rust was very common in wheat fields, particularly in the southeastern quarter of the United States. It was found by the survey men in practically every locality visited except in some of the

more northern counties of the country. West of the Mississippi and in the northern tiers of states the disease was not nearly so abundant and did not seem to be of any particular consequence.

The economic importance of this rust has been questioned by many pathologists. It is maintained that the affection of the leaves, coming on rather late in the season, as it usually does, does not materially reduce the size or number of kernels. After the kernels are well formed it is said that the leaves are not necessary for full development of the grain so long as the culms remain green. In 1917, collaborators were asked in a questionnaire if they considered the disease of economic importance and replies from Pennsylvania, Maryland, North Carolina, South Carolina, Tennessee and Indiana were in the affirmative. Collaborators in most of the other states indicated that usually it was not of importance. In Oregon it was said to be of importance on certain varieties only. The results secured by the survey men in 1918 indicate that there was considerable crop injury in many of the eastern states. The amount of reduction in yield could not be determined, but it was thought to be decidedly appreciable. The following table shows the average percentages of rust found in the various states.

Table XX. Average percentages leaf rust (according to scale for estimating cereal rusts) as found by field men, 1918.

State	Results of Plant Disease Survey men.				Results of Cereal Office Men	
	No. acres inspected	% affected plants	% affected leaf area on affected plants	Average % affected leaf area	No fields inspected	Average % affected leaf area
Me.	-	-	-	-	67	15.
N. H.	-	-	-	-	83	12.
Vt.	-	-	-	-	161	19.
Mass.	-	-	-	-	12	7.6
R. I.	-	-	-	-	1	65.
Conn.	-	-	-	-	76	9.2
N. Y.	409.5	74	27	20	237	17.
N. J.	-	-	-	-	73	43.
Pa.	1407.	85	78	66	364	48.7
Md.	259.	80	36	29	95	28.9
Va.	701.	100	39	37	323	37.9
W. Va.	-	-	-	-	144	47.9
N. C.	343.	94	31	29	249	29.7
S. C.	296.	79	24	19	38	35.8
Ga.	356.	96	33	32	133	26.3
Ohio	1037.5	96	54	52	348	28.8
Ind.	218.	96	36	35	158	-
Ill.	350	83	12	10	51	6.5
Mich.	814.	87	32	28	228	20.6
Wis.	1163.	87	28	22	251	39.7
Minn.	-	-	-	-	789	7.
Iowa	2507	85	16	14	435	13.
Mo.	3491	100	18	18	817	8.3

State	Results of Plant Disease Survey men.				Results Cereal Office Men.	
	No. acres inspected	% affected plants	% affected leaf area on affected plants	Average % affected leaf area	No. fields inspected	Average % affected leaf area
N. D.	-	-	-	-	203	-
S. D.	3182.	72	14	10	22	9.6
Nebr.	1668	73	37	27	237	5.
Kans.	2767.5	77	20	15	197	5.2
Ky.	1417.5	100	68	68	211	30.3
Tenn.	1142.	99	54	53	244	28.
Ala.	69	100	55	55	225	30.5
Miss.	-	-	-	-	169	25.9
La.	-	-	-	-	17	55.8
Texas	878.5	80	23	18	190	1.4
Okla.	1440.	79	35	28	167	6.6
Ark.	448.1	98	41	40	157	-
Mont.	-	-	-	-	208	t
Wyo.	-	-	-	-	41	t
Colo.	-	-	-	-	77	t
Wash.	-	-	-	-	806	t
Calif.	-	-	-	-	341	t

According to observations of the field men, the amount of damage depends largely on the time and severity of the early infections and on the weather during the earlier part of development of the wheat. If infection is heavy very early in the history of the plant and conditions are favorable for the rust, it can easily be seen that damage must result.

It was the common observation of the field men that leaf rust was more abundant on the most vigorous plants and less so on the poorer plants. It seemed to be worst in spots in fields where the growth was heavy and where the dew stayed on the plants longest. Less disease appeared to be present in the small and isolated fields and in fields where the stand was thin.

Temperature seemed to be an important factor in influencing the development of leaf rust. A rather high temperature seemed to favor it. In northern Michigan the moisture relation seemed favorable but it was cool and there was very little rust. It was also noticed by the field men that the abundance of the rust, the losses that it occasioned, and the frequency of teliospore formation decreased as they proceeded from the southern states to those in the north. This points to the temperature relation as being important. Again in Tennessee it was noticed that there was less rust on higher grounds. In the mountains of that state there was an average of about 5% affected leaf area while in the valleys 90% was the rule.

Teliospore formation was found to be abundant in such states as Alabama, Tennessee, Kentucky, Texas, Oklahoma, Kansas and Nebraska. It was fairly common in South Dakota and southern Michigan, but rare in northern Michigan.

Differences in varietal susceptibility were noted, but they were not very marked. Early maturing varieties such as Marquis and some others showed less rust in the western part of the area surveyed than did later ones. In South Dakota, however, Marquis planted later showed considerable rust. It was thought that when planted early it matured before the heavy infection

period came on. It was noted by a number of field men that it was worse on winter than on spring wheat. One man estimated 93% affected leaf area on winter wheat seen and 45% on spring wheat.

In a number of the southern states, it is evident that infection takes place in the fall and the rust lives over winter on the plants and is plentiful in the spring when weather conditions become right for spring infection. This is probably one reason why the disease is worst in the south.

Scab caused by Fusarium sp.

Scab was reported in 1918 from all wheat states east of the Missouri River and two reports were received from Montana for the first time. A glance through the survey records from 1903 to 1917 shows that the only reports from states west of the Missouri are from Oregon in 1917 and from Utah in 1916 and 1917. In both of these states the disease was rare, however. Since 1903, scab has been reported most frequently from states in the belt that extends from Pennsylvania and Delaware westward to Nebraska and the Dakotas.

It is noticeable that the area where scab occurs is more or less coincident with the belt where corn and wheat are both grown. In states such as Minnesota and Wisconsin, it is significant that scab occurred only in the southern portions where corn is grown. The fact that the scab and corn areas coincide adds further proof that wheat scab and corn root rot may be caused by the same organism.

In 1918, scab was most severe in parts of New Jersey, Pennsylvania, Maryland, Virginia, West Virginia, Kentucky, Tennessee, Ohio, Indiana, Illinois, and Missouri on winter wheat. It was severe on spring wheat in Iowa, southern Minnesota, and South Dakota.

It seems to be abundant annually in Tennessee and states bordering on the Ohio River, but last season it was unusually so. The highest percentage of loss occurred in Kentucky (3.2%), Tennessee (2.2%), Pennsylvania (3%), Ohio (2%), Virginia (1.5%), West Virginia (1.5%), and Iowa, while the greatest losses in bushels occurred in Ohio, Illinois, Indiana, and Kentucky.

The disease became prevalent in the spring wheat states in August, considerably later than in the winter wheat area. Dates of first appearance of scab were reported as follows:

May 16 - Georgia	June 1 - Illinois	June 29 - New York
May 20 - Tennessee	June 1 - Missouri	July - Connecticut
May 30 - Kentucky	June 8 - Ohio	July 10 - Wisconsin
June 1 - Virginia	June 13 - Pennsylvania	August - Minnesota

Marquis was reported as especially susceptible in Iowa, Minnesota, North Dakota and South Dakota. Durum was susceptible in Minnesota and North Dakota and Turkey Red in Iowa.

Stripe rust caused by Puccinia glumarum (Schm.) Er. & Hw.

Stripe rust of wheat was reported to the Survey only from Washington (Snohomish and Clarke Counties).

Nematode caused by Tylenchus tritici Bauer.

The geographical range of wheat nematode was more definitely determined during the year 1918. In 1917, it was reported from a number of points in Virginia, and one locality in California. In 1918, a description and specimens were put into the hands of collaborators in all states. Field men of the Department of Agriculture were asked to keep watch for the disease and in addition a special survey of Virginia was made by the Plant Disease Survey.

As a result of the survey and propaganda work, the nematode was found in 13 new counties in Virginia and also in three new states; namely, West Virginia (6 counties), Maryland (2 counties) and Georgia (1 county). The following is a list of counties where nematode was found on wheat in 1917 and 1918:

Virginia
- Albemarle
- Amelia
- Augusta
- Campbell
- Caroline
- Clarke
- Culpeper
- Fauquier
- Fluvanna
- Frederick
- Greensville
- King George
- Loudoun
- Louisa
- Montgomery
- Page
- Prince William
- Rockbridge
- Rockingham
- Shenandoah
- Spotsylvania
- Stafford
- Wythe

West Virginia
- Monroe
- Greenbriar
- Pendleton
- Grant
- Hardy
- Jefferson

Maryland
- Montgomery
- Alleghany

Georgia
- Jackson

A report was received also from a Virginia miller of the disease occurring at Norwood, Stanley County, North Carolina in 1914. This report has not been substantiated however. Search was made in 24 additional counties in Virginia without finding the disease. The accompanying map shows the general locality of the counties from which nematode has been reported.

In Virginia, the disease appeared to be most serious in the region of Rockingham, Shenandoah and Albemarle Counties. In Rockingham County, 20% nematode galls were found in the wheat on one farm and about 50% galls were found in the screenings at one of the mills. A field of wheat with 54% galls was found near Woodstock in Shenandoah County and another with 50% at Morrisville, Fauquier County. On the whole, however, the percentages of diseased wheat were very small, being in many cases only a trace in the screenings at some of the mills. The high percentages occurred only in isolated instances. The actual average loss for the state, therefore, will be small.

The disease is thought to have been present in Virginia for a considerable length of time. Some farmers stated that they noticed the disease as long as 30 years ago and many of them have observed it for ten to fifteen years.

Virginia farmers do not make a practice of changing their seed very often, but use their own wheat for a number of years. If it becomes unsatisfactory they usually replace it with some from a neighbor. This practice tends to keep the disease more or less localized. In some of the counties where the disease is worst, wheat is commonly planted two or even more years in succession on the same piece of land. This, of course, tends to increase the amount of disease in each succeeding crop.

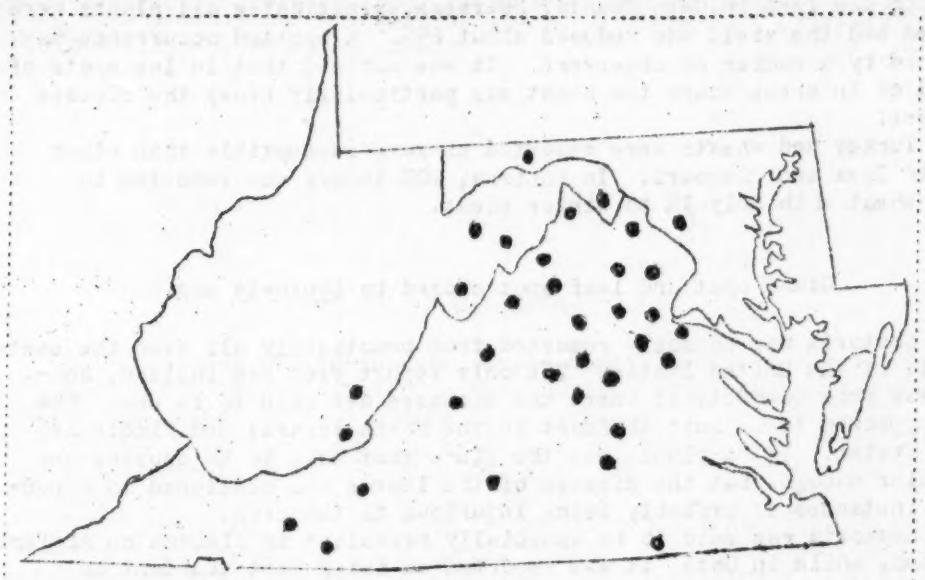

Fig. 6. Map of Maryland, Virginia, and West Virginia showing location of counties from which wheat nematode has been reported.

The only control commonly practiced has been the use of new seed on farms where the disease becomes troublesome. Virginia officials plan to reduce the disease by encouraging the use of the salt brine method of seed treatment and crop rotation.

Black chaff caused by Bacterium translucens var. undulosum. Smith, Jones and Reddy.

Black chaff was reported by collaborators in 1918 from Indiana, Wisconsin, Iowa, Missouri, Arkansas, Kansas, Nebraska, Oklahoma, South Dakota, and Montana. Suspicious cases were also reported by collaborators in Alabama, Tennessee, and West Virginia, but because of the somewhat uncertain identity these are not listed as definite occurrences. Prior to 1918, the disease had not been found east of Illinois, but during the 1918 season it was located in Indiana, and the suspicious cases already mentioned were found in states still further east.

The disease undoubtedly caused considerable loss in some states, especially in Montana, Iowa, and Nebraska. In Montana, abundant instances were seen where the reduction in yield was estimated by H.M.Jennison as 50%, and cases were seen where 80-90% loss was incurred. In this state it was found doing damage everywhere. J. D. More reported the following percentages of affected plants in states visited:

Oklahoma - Medford 1%, most fields without any.
Kansas - Winfield 20%, localized in spots.
McPherson 20%, localized in spots.
Nebraska - Beatrice 18%, general in most fields.
Fullerton 5%, general in local fields.
South Dakota - Miller 5%, general in local fields.
Mitchell 5%, general in local fields.

On one farm in Gage County, Nebraska, practically all plants were attacked and the yield was reduced about 25%. A spotted occurrence was mentioned by a number of observers. It was noticed that in low spots of a field or in areas where the wheat was particularly heavy the disease was worst.

Turkey Red wheats were reported as more susceptible than other sorts in Iowa and Missouri. In Montana, 20% injury was reported to spring wheat with only 1% to winter wheat.

Glume spot and leaf spot caused by Septoria spp.

Septoria was commonly reported from practically all over the eastern half of the United States. The only report from New England, however, was from Connecticut where the diseases are said to be new. The fungi appeared to be most abundant in the North Central and Middle Atlantic States. In no place was the glume spot said to be causing any particular damage, but the disease of the leaves was mentioned in a number of instances as probably being injurious to the crop.

Septoria was said to be especially prevalent in Alabama on Alabama Blue Stem, while in Ohio, it was reported as being most abundant on Velvet Chaff and other wheats with hairy glumes. In Ohio, it was very abundant on winter wheat, but practically absent from spring wheat.

Anthracnose caused by Colletotrichum cereale. Manns.

Anthracnose was reported in wheat from Pennsylvania, Virginia, Ohio, Georgia, Alabama, and Minnesota. The disease was by far the worst in the first three states named, in all of which it was more prevalent than usual. In Ohio, it approached an epidemic, being present in every county inpsected in amounts ranging from 2-26% affected plants. The losses in the northern part of Ohio were said to exceed those from scab. For the entire state a loss of 4% was estimated. In Virginia, the disease was especially serious in the south central portion of the state. As much as 10% damage was observed in some fields while the general average loss for the state was placed at 1%. In the southern and western states, the disease seems to have been of practically no consequence. It was first noticed May 1 at Athens, Georgia.

Ergot caused by Claviceps purpurea. (Fr.) Tul.

Ergot seems to be increasing on wheat in some of the north central states, as last year it was reported from Illinois, Wisconsin, Minnesota, North Dakota, and Nebraska. In no state, did it do more than a trace of damage, although in Wisconsin two fields were found with about 1% affected heads.

Powdery mildew caused by Erysiphe graminis De C.

Powdery mildew was common, as usual, in the eastern part of the country. It was reported from New England, New York, Pennsylvania, Maryland, Ohio, Kentucky, Tennessee, Colorado, Montana, Washington, and Oregon. Judging from these reports, it was most abundant in Pennsylvania. In this state, it probably caused some loss. Observers mention mildew

as being most abundant in the moister and shady portions of fields. It was first noticed by dates as follows:

June 8 - Oregon
June 21 - New York
July 3 - Connecticut
July 4 - New Hampshire
July 5 - Pennsylvania

Other diseases.

Winter killing was common and caused heavy losses in the northern portion of the country, especially in New England, New York, Michigan, Wisconsin, Minnesota, Montana, Idaho, and Washington. In New York, where a special effort was made to determine the extent of injury, the average of 48 reports from 34 counties showed 37% of the crop injured. All varieties in the state are equally injured.

Stripe and blight, thought to be caused by Helminthosporium sp., was reported from Montana in many spring wheat fields. It was found at its worst in the south central part of the state. As high as 75% of the leaf blades in some fields were affected. It did the most damage to Marquis wheat. What was apparently the same disease was reported in 1916 from the western part of the state.

The following description of the disease was furnished by H. M. Jennison:

"The leaf blades are affected, the lower ones first and later the upper. The young lesions vary in size, are usually longer than wide, rather irregular in outline, with a light brown margin and darker center. Older lesions are longer, forming stripes that are quite uniformally light brown in color. Severely affected plants show systemic effects. The heads are often very light and in many cases there is a noticeable failure to fill at the tip."

The same or a similar leaf stripe, said to be due to Helminthosporium, was reported from New York in 115 fields in 11 western counties. An average of 10% of the leaves were affected in the 115 fields, but the actual damage was slight.

From North Dakota, H. L. Bolley reported considerable blighting of wheat plants in old crop regions which was thought to be due to infection by Helminthosporium.

RYE

Ergot caused by Claviceps purpurea (Fr.) Tul.

Ergot was reported from most of the states in the northeastern part of the country, as far west as the Dakotas and as far south as Oklahoma, Arkansas and Georgia. It appeared to be most abundant in Ohio, Indiana, Illinois, and Michigan. In these states, and also in Connecticut, Iowa, and North Dakota, it was said to be much more abundant than usual. In the remainder of the states the disease apparently occurred in about the normal amounts.

The loss from ergot to the crop in bushels is not excessive for as a rule only a few (2-8) of the kernels per head are affected, and the percentages of affected heads do not usually average very high for any one entire field. The percentage reduction in yield of grain estimated as being due to ergot in 1918 and the approximate number of bushels lost is given in the following table:

Table XXI. Estimated reduction in yield of rye because of ergot, United States, 1918.

State	Percentage affected kernels	Bushels
Massachusetts	trace	+
Connecticut	"	+
New York	"	+
New Jersey	.3	4,000
Pennsylvania	.5	21,000
Georgia	trace	+
Illinois	.2	8,000
Michigan	trace	+
Wisconsin	.21	16,000
Minnesota	.13	11,000
Iowa	.23	2,000
Missouri	trace	+
North Dakota	.01	2,000
Nebraska	trace	+
Kansas	"	+
Kentucky	"	+
Arkansas	.2	+
United States	.07	64,000+

In addition to the bushel loss, the dockage in price made by the millers and the dangers of stock poisoning are factors that should be taken into consideration on estimating damage.

Some commercial rye fields were found with as high as 20-30% ergotized heads, but this was the exception. The disease was not uncommonly found, however, affecting as high as 90% of the spikes in volunteer rye appearing in wheat or other crops on land that had been planted with rye the previous year. In certain wheat fields, where there was considerable affected volunteer rye the wheat was often reported with ergot.

Indications are that ergot is increasing in amounts and destructiveness in the larger rye sections of the country. The following reports of collaborators in various rye growing states are of interest.

North Dakota (Bolley), "Claviceps purpurea is to become one of the most common of the destructive diseases. Conditions here, such as the presence of native wild grass hosts and perhaps climatic conditions, seem to be particularly favorable. Infection was certainly more intense, in some fields at least, this year than last. These intensely affected fields seem to be in neighborhoods where rye is most commonly cropped or on land where rye follows rye most closely."

Illinois (Anderson, H. W.), "Observations have been made on the occurrence of ergot in the vicinity of Lafayette, Ladoga, and Crawfordsville, Indiana; and Urbana, Champaign, Springfield, and Rantoul, Illinois.

Reports have also been received from other places in the latter state. Everywhere I have been in Indiana and Illinois I have found ergot running from 2-10% in rye fields. In fields where rye has been mixed with wheat and where sometimes 1/10 of the field is rye the ergotted heads run very high. In one field, I found 90% of the heads having ergot. In two timothy fields, I also found 90% of the volunteer rye ergotized. It seems well to call attention to the unusual prevalence of ergot at this time on account of the danger of stock poisoning. For a number of years I have watched ergot about Ladoga, Indiana, and each summer have had difficulty in getting sufficient material for class use. I know, therefore, that the condition this year is very unusual. One remarkable thing is the greater amount of infection in the edge of the field than in the central portion. Twenty percent as compared to 5% is the usual condition.

"About Springfield, Illinois, we have found heads of wheat with ergot rather abundant, and about Urbana and Champaign Agrostis alba has been found heavily affected."

Michigan (Woodcock, E. F.), "The disease is quite general in the state. Fifty-five percent of the fields visited showed the heads infected. In only one field, was the percentage of infected heads over 3%. This particular field showed 75%. The soil was poor and the grower failed to practice rotation of crops."

Seed treatment for the control of ergot does not seem to be commonly practiced although, where used, the salt brine method is said to give good results when the seed is planted on clean soil.

Stem smut caused by Urocystis occulta (Wallr.) Ret.

This smut was reported from most of the states in the northeastern quarter of the United States and also from Oklahoma, Texas, Alabama, and the Carolinas. In the eastern states, such as New England and the Atlantic States, the disease seems to be rare and not of any special economic importance. In the North Central States, from Ohio west, however, it is reported as causing some damage. It is estimated that on the average it caused state losses ranging from .2% to 1.3% in these North Central States, and because of the wide range of the disease in this important rye region and the nature of the malady itself it is thought to have caused heavier losses for the United States as a whole than did ergot.

Reports seem to indicate that the disease was present in about the same amounts as usual. Formaldehyde treatment of the seed grain does not seem to be at all common and on the whole may be unnecessary except in local instances. The treatment is said to be used in Minnesota to some extent.

Stem rust caused by Puccinia graminis Pers.

Stem rust was reported from practically all states east of the north and south line running from the western boundary of the Dakotas through Texas. No 1918 reports are at hand to indicate occurrence west of that line. In most all states, the disease was of very slight importance and was usually scattered. It probably caused the heaviest losses in Wisconsin. It occurred widely all over this state and many fields showed 100% infection.

Leaf rust caused by Puccinia dispersa Erik.

Leaf rust was reported from all over the eastern half of the United States. Information on the occurrence of this rust was collected by men from both the Cereal and Plant Disease Survey Offices. The disease was most common and in some cases destructive in such states as Virginia, North Carolina, Ohio, Kentucky, Tennessee, Missouri, and Arkansas. The following figures show the percentage of affected leaf area in states where counts were made by men from the Survey Office.

Table XXII. Percentages of leaf area affected with leaf rust as found by survey men in May, June, and July, 1918.

State	Average % affected leaf area	State	Average % affected leaf area
New York	16	Ohio	27
Pennsylvania	12	Illinois	t
Virginia	25	Michigan	26
Kentucky	37	Wisconsin	10
Tennessee	42	Iowa	3
North Carolina	52	Missouri	20
South Carolina	3	Arkansas	37
Georgia	3	Nebraska	t
Alabama	15		

One field of rye was reported in northern Indiana which on June 23 was in such a bad condition from leaf rust that the crop was no higher than lawn grass and only a few plants were able to form heads. When one walked through this field a red cloud of rust spores was evidenced.

Although the field men were on the watch for differences in varietal susceptitility none was noticed.

Anthracnose caused by Colletotrichum cereale Manns.

Anthracnose was reported from Pennsylvania, Virginia, Tennessee, Louisiana, Oklahoma, Ohio, Missouri, Wisconsin, and Minnesota. In Pennsylvania, 2-5% of the crop was reported injured, in Virginia 3-5%, in Missouri 3-5% and in Tennessee and Ohio was severe in some sections. In certain individual fields, the reduction in yield because of anthracnose was reported as high as 33% (Minnesota), 50% (Missouri, Fayette), 50-60% injury (Oklahoma).

Other diseases.

Powdery mildew (Erysiphe graminis DeC.) was reported from a number of states but particularly from Massachusetts where it is estimated that it caused 2% damage. In that state it was the worst rye disease. In many fields the foliage was completely destroyed and in others from 50-80% of the leaves died prematurely.

Scab, caused by Fusarium spp., is commonly reported on rye. This year it was reported as follows: Connecticut (two reports, first seen July 3.), Minnesota (trace), Missouri (slight), Tennessee (5% injury, reported June 1), Wisconsin (trace reported first in July), and Iowa (reported from nine counties by men engaged in cereal survey).

Wilt, thought to be caused by a fungus in the culm, was reported by Clinton from Connecticut. The stalks of affected plants turn yellow before maturing heads and are thus easily distinguished from those of healthy plants with green stems. Occasionally entire stools are killed. The disease was seen most easily in June and not so readily recognized later.

It was quite common in some fields all of which were located in New Haven County.

Rhynchosporium graminicola Hein. was reported on rye by Vaughan from Wisconsin. It occurred in small amounts in a number of fields throughout the central part of the state but was of decidedly minor importance. It was first noticed in May.

Sterility of rye was said to be very common in Pennsylvania. Specimens received at the Experiment Station would seem to indicate as high as 50% sterile spikelets about the state.

BARLEY

Loose smut caused by Ustilago nuda (Jens.) Kell. & Sw.

Loose smut undoubtedly occurred, at least in small amounts, in practically every locality where the crop was grown. Fortunately it was worst in states other than those that rank first in the production of barley. Thus in Wisconsin, Minnesota, and the Dakotas, the disease although common was not especially destructive except in small local areas. The average loss for Wisconsin is estimated at about .8%, while that for Minnesota and the Dakotas probably did not exceed 1%. The heaviest losses are recorded from Indiana (6%, about 9% loss in nine counties surveyed in central-western part of state), Oklahoma (8%), Mississippi (7%), Alabama, Tennessee, and Maryland. A report of the losses by states is given in another number of this Bulletin (Pl. Dis. Bul. Supl. 6, 1919.). The total loss for the United States is given as .9% or 2,381,000 bushels.

Pennsylvania reported perfect control with hot water, Wisconsin reported good results by soaking two hours in formaldehyde, and in New York experiences indicated that the dry (spray) formaldehyde treatment can be used in controlling the disease in two-rowed barley, but not in other varieties.

Covered smut caused by Ustilago hordei (Pers.) Kell. & Sw.

Covered smut seemed to be even more widely distributed than loose smut and was responsible for a greater loss to the country as a whole. In the northeastern portion of the United States, including Indiana, Ohio, and Tennessee, it was not generally so severe as was loose smut. In Michigan, Iowa, Missouri, and Kansas the two smuts seemed to be of about equal prevalence, while in the remainder of the country, and this includes the great barley producing states, covered smut was the more important of the two diseases.

Covered smut is reported as being satisfactorily controlled where formaldehyde is used, but the high percentages of smut indicate that seed treatment is not employed widely enough.

Stripe caused by Helminthosporium gramineum (Rab.) Erik.

Stripe is now recognized as one of the most serious barley diseases and ranks in importance along with smuts. Last year it was widespread over the country from Oregon to New England and has become well established, particularly in the principle barley producing sections. It is only until comparatively recently, however, that pathologists have recognized the disease as of a serious nature and needless to say it is still unknown to many county agents and farmers. Although formaldehyde (1-40 for 2 hours) has been reported as giving good results in Wisconsin, the control measures are not fully understood and so are not generally practicted.

In Wisconsin, observations were made during the summer in 540 fields of barley and an average of all counts made showed the disease to be present to the extent of 5.2% affected plants. Since the disease is systemic and causes a failure of the heads to mature 5.2% diseased plants means that much loss. The amount varied from 0 to 50%. It is said to have been more abundant in 1918 than in 1917.

In Michigan, observations were made in 53 fields in 12 counties by E. F. Woodcock. The disease was present in 76% of these fields and in 34 of them it was present in amounts of more than 1%. The average amount of disease in the entire 53 fields was about 3.8% (trace min.to 30% mas.). The disease occurred commonly on native as well as introduced seed, showing that it has become well established. It appeared, however, that stripe occurred in higher percentages in various pedigreed varieties than in the common run of barley. It is stated that in Michigan the disease is of more importance than either of the smuts.

In Indiana, E. H. Toole made examinations in 18 barley fields in the northern part of the state. Stripe was present in six fields, ranging in amounts from a trace to 10%.

In Minnesota, the disease is very common and widespread and occasionally found running as high as 40% in individual fields. It is said to be as prevalent as covered smut and is estimated as causing about 1.4%, or 570,000 bushels, loss in the state in 1918.

Net blotch caused by Helminthosporium teres Sacc.

Net blotch occurred throughout the northern part of the United States, but did little or no damage except in certain parts of Wisconsin. In Rusk and Taylor Counties of that state, 100% of the plants are reported affected, but for the state as a whole the loss is small. In Emmet and Chippewa Counties, Michigan, 50 and 56% disease was reported respectively. In the other states, net blotch occurred in slight amounts only, and the loss was inappreciable. Texas is the only southern state from which it was reported and there it occurred in only slight amounts in one county.

Spot blotch caused by Helminthosporium sativum (Pers.) K.&B.

This disease, while occurring quite widely over the northern part of the country, is apparently not causing much damage and is relatively unimportant. It seems to be most general in Wisconsin, but even in this state

is mostly in the southern part. In the other states, also, it appears to be more or less localized. The disease has not been noted west of the Rocky Mountains, and Texas is the only southern state from which it has been reported. E. H. Toole reports a case at Wingate, Indiana, where the fungus attacked young plants and in places in the field 5% of the plants were dwarfed or killed in addition to the blotches covering 5% of the leaf area of all plants.

Stem rust caused by Puccinia graminis Pers.

Stem rust was not very prevalent in 1918 nor did it do much damage to the barley crop. It occurred in spots or areas of various sizes and in many cases the relation of the presence of barberry bushes to these local occurrences was very evident. A large number of observations showing this relation were made by persons engaged in the "Barberry Eradication Campaign" and by others. Many of these spot infections extended over as large an area as a county and in some of these the disease was severe. Thus in Sawyer and Winnebago Counties, Wisconsin, there was 100% and 28% heavy infection, respectively, while in the majority of the other counties the disease was less severe or entirely absent. In Minnesota some counties showed as high as 28%, 18%, and 13% disease while other neighboring counties would have only a trace or none at all. In general, these two barley states suffered the most loss from the disease of any.

Stem rust appeared later than usual and so did not do much damage. Furthermore, it is probable that the work of eradicating the barberries, at least in some sections, was responsible for a considerable suppression of the disease. As the work progresses, the results of this effort should be still more evident.

Leaf rust caused by Puccinia simplex Eriks. and Henn.

This disease, which has been reported in years past most frequently from west of the Rocky Mountains, was reported this year from a number of states east of the Mississippi River. It was reported by collaborators from Vermont, Massachusetts, New York, Tennessee, Indiana, Michigan, Wisconsin, Minnesota, Iowa, Missouri, South Dakota, Montana, Colorado and Oregon. Scouts of the Plant Disease Survey found it also in Kentucky.

The following percentages of affected leaf area were found by field men of the Plant Disease Survey:

New York	trace	Iowa	trace
Indiana	1.8	South Dakota	.3
Michigan	trace	Kentucky	60.
Wisconsin	.1	Tennessee	33.

In no case did there appear to be any reduction in yield. Examinations in Alabama, Georgia, South Carolina, North Carolina, Virginia, Maryland, Pennsylvania, Ohio, Illinois, Missouri and Arkansas failed to reveal its presence.

Yellow stripe caused by Puccinia glumarum (Schm.) Er.&Hw.

Reported as being of negligible importance in Oregon.

Leaf spot caused by Rhynchosporium graminicola Hein.

Reported from California (considerable locally) caused considerable damage in experimental plots at Chico, Minnesota (common), Oregon (more severe than usual, very heavy infection noted in some fields in west and about Corvallis, not observed in southern counties), Washington (moderate) and Wisconsin (slight locally).

Anthracnose caused by Colletotrichum cereale Manns.

Reported from Minnesota and Iowa. In the latter state, it was said to be common and probably doing considerable damage.

Powdery mildew caused by Erysiphe graminis DeC.

Reported from Vermont (common in fall), Connecticut (not bad this year), New York (trace in nearly all fields) and Indiana (rather heavy in a few cases).

Ergot caused by Claviceps purpurea (Fr.) Tul.

Ergot is not commonly reported on barley, but this year it was found in Indiana, Michigan and Wisconsin. In the latter state, the disease was first reported in July and was limited in extent but more abundant than is usually the case.

Other diseases.

A bacterial leaf blight of uncertain cause, and causing only slight damage was reported as general in Wisconsin, particularly in the southeastern portion of the state and in Indiana, near Lafayette. Another disease which may or may not be the same was observed by Reddy and Jennison in Montana affecting the basal portions of the leaves and causing some damage in at least one field of "purple hulled" variety. Ohio also reports a leaf blight of a bacterial nature.

Scab, caused by Fusarium spp., was reported from Wisconsin (local, but more than 1917) and Minnesota (local, trace).

Root rot, of uncertain cause but tentatively ascribed to a species of Rhizoctonia, was reported from Washington.

Root rot, caused by Fusarium sp., was reported from Minnesota.

False stripe was reported from New York (common about Ithaca), Indiana and Wisconsin.

Frost injured barley considerably in northern Indiana and southern Michigan, June 23. Some fields were killed down completely when well headed out.

OAT

Smut caused by Ustilago avenae (Pers.) Jens. and U. levis (Kel.& Sw.)Mag.

The oat smuts occurred widely in all states. They were prevalent in about the same amounts as usual although for the country as a whole there was probably less smut owing to the seed treatment campaign carried on by the Depart-

ment of Agriculture cooperating with the states. Thus, in 1917, the estimated average amount of smut for the United States was placed at 5.26% (Pl.Dis.Bul. 2:8, 1918) while the estimates of the Plant Disease Survey for 1918 show only 4.2% for the entire country, an apparent reduction of about 1%.

The aggregate loss to the oat crop from these two smuts is enormous. The 5.26% loss to the crop in 1917 amounted to about 91,655,000 bushels or almost as much as our export during that calendar year. The 4.2% loss estimated for 1918 and which is based on actual counts in many fields is equivalent to a loss of at least 64,396,000 buehsls. The following table shows the determination of percentages of smut by states as made by field men engaged in the cereal survey of 1918. The final estimates of the Plant Disease Survey, which will be published later, are somewhat different from these.

Table XXIII. Average percentages of oat smut, loose (Ustilago avenae) and covered (U. levis), as found by field scouts of the Office of Cereal Investigations, 1918.

State	Production 1918 Bushels (000 omitted	No. of fields inspected	Average % oat smut	State	Production 1918 Bushels (000 omitted	No. of fields inspected	Average % oat smut
Me.	6,760	231	2.4	Mo.	44,196	493	4.4
N. H.	912	103	3.	N. D.	60,512	78	4.8
Vt.	4,223	209	2.8	S. D.	84,240	101	3.2
Mass.	480	27	4.6	Neb.	56,188	111	4.8
R. I.	84	14	6.5	Kans.	51,238	144	3.9
Conn.	912	80	2.5	Ky.	9,600	25	5.
N. Y.	51,660	558	3.3	Tenn.	8,125	62	4.5
N. J.	3,400	29	2.3	Ala.	8,132	568	5.
Penn.	47,190	91	3.9	Miss.	5,600	231	5.
Del.	175			La.	2,000	94	2.7
Md.	1,980	10	1.4	Texas	22,197	209	8.7
Va.	5,175	16	6.	Okla.	33,120	184	5.6
W. Va.	4,320	9	1.8	Ark.	11,271	106	5.6
N. C.	6,500	88	8.2	Mont.	20,400	58	1.9
S. C.	11,000	68	6.2	Wyo.	11,685	24	2.5
Ga.	12,000	142	7.6	Colo.	9,669	16	5.5
Fla.	1,080			N. Mex.	1,260		
Ohio	79,200	45	7.2	Ariz.	440		
Ind.	85,050	393	3.6	Utah	4,410		
Ill.	198,352	53	6.6	Nev.	532		
Mich.	66,320	230	4.	Idaho	9,480		
Wis.	110,162	359	3.	Wash.	8,370	235	2.9
Minn.	134,562	558	2.6	Oreg.	9,025		
Iowa	229,572	347	1.1	Calif.	5,600	27	1.6

In connection with the attempt to learn more about the geographical distribution of the two kinds of bunt on wheat as reported page 119, a similar effort was made also with respect to the oat smuts. A summary of questionnaires has yielded the following results.

Table XXIV. Number of individual collections of loose smut (Ustilago avenae) and covered smut (U. levis) in various states and Canada as shown by replies of collaborators and others to questionnaires. Determinations based on microscopic determination.

State	Number of collections		State	Number of collections.	
	Ustilago avenae	Ustilago levis		Ustilago avenae	Ustilago levis
Me.	-	1	S. D.	1	4
N. H.	2	-	Nebr.	6	5
Vt.	3	2	Kans.	-	1
Conn.	7	3	Ky.	1	-
N. Y.	19	7	Tenn.	4	-
Penn.	3	-	Texas	2	1
Va.	2	5	Okla.	1	-
N. C.	2	3	Mont.	1	1
S. C.	-	1	Wyo.	1	2
Ind.	1	10	N.Mex.	2	12
Ill.	7	5	Utah	-	7
Wis.	24	46	Idaho	-	2
Minn.	37	23	Wash.	16	4
Iowa	5	4	Ore.	6	18
Mo.	390	240	Canada:	17*	10+
N. D.	3	2			

* Reported from each of the following: Quebec, Prince Edward Island, Ontario.
\+ Reported from each of the following: Quebec, Prince Edward Island, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia.

Treatment of the seed with formaldehyde was undoubtedly far more widely practiced than usual owing to the stimulus of the seed treatment campaign. Reliable data are not at hand to show the extent to which seed treatment was practiced. In some states, it is known that the great majority of farmers treated while in others, cases of treatment were rare.

A number of states such as New York, Georgia, Ohio, Michigan, and Kansas reported very good results with the dry, pint to pint method.

Stem rust caused by Puccinia graminis Pers.

Stem rust was reported from most parts of the country. Nevada is the only state west of Colorado that reports the disease and there only a small amount is mentioned as occurring. In general, the disease caused less loss than usual and was, in no state, a serious factor. For the most part it occurred locally and in small amounts. In South Dakota and Minnesota, stem rust was said to be more common on late than on early oats. Like the leaf rust, this disease was rather more severe in the southern states, probably being influenced by the fact that the majority of the southern oats are sown in the fall.

Leaf rust caused by Puccinia coronata Cda.

Leaf rust occurred widely over the country as far west as Colorado and Arizona. No reports were received of its occurrence from the Pacific Coast States. The disease was most serious to oats in the southern states,

thus Florida reports leaf rust and stem rust as the two most serious oat diseases and in Louisiana all the plants were said to be affected and a loss of 5 to 10% is estimated for the state. Much of the oat crop in the South is fall sown which probably accounts for greater losses from leaf rust in that portion of the country. The amount of injury apparently became increasinly less farther north.

The following estimates of damage were made by collaborators:

Vermont.....75% injury	Pennsylvania...50-75% injury, 2% loss
Massachusetts..Trace injury	West Virginia..10% injury
Connecticut....1/4% injury	Kentucky.....5% loss
New York.....Very slight injury.	Tennessee.....Severe in some sections
S. Carolina....80% injury	Missouri.....Less than 1% injury
Georgia.....Loss small	Minnesota.....Small loss
Louisiana.....Practically 100% injury	Colorado.....Small loss
	Arkansas.....1% injury

The rust was reported as first being noticed on oats in 1918 as follows:

April.....Louisiana	July 3.....Connecticut
April 15.....Tennessee	July 20.....Minnesota
May 20.....Georgia	August 1.....Pennsylvania
June.....Oklahoma	August 1.....Vermont
June.....Wisconsin	

A close association of badly infested fields with Rhamnus was noted in Wisconsin. It is probable that further careful surveys would show similar relations in other states.

Anthracnose caused by Colletotrichum cereale Manns.

Reported from Ohio (Prevalent in northern part, 25% stalks attacked in some places), Minnesota (Trace), Iowa (Prevalent in central part).

Leaf blight caused by Helminthosporium sp.

Reported from New York (Present in all fields inspected in Yates, Ontario, Monroe, and Genesee Counties, but only a trace of injury), Wisconsin (Limited as usual, only very slight injury).

Sterility, cause not definitely known.

Reported from New York under the name of blast (Monroe, Tompkins, and Franklin Counties, only slight loss), Pennsylvania (General and about as usual, average estimated loss about 6%; Huntingdon County about 20% loss, Erie County about 10%, Cumberland, Luzerne and Clarion Counties 5%), Michigan (No special injury), Minnesota (General, about as usual, perhaps 1% of crop injured, some individual fields badly blasted), Iowa (Very prevalent on all varieties), North Dakota (Considerable complaint and many specimens received showing considerable damage).

Bacterial blights

Reported from New York (Western portion, only very slight injury), Ohio (Williams, Paulding, Van Wert, Union, Wayne, and Columbia Counties), Wisconsin (More than usual, widely scattered, only a trace of loss), Kansas (Halo blight rare), Montana (Typical halo blight lesions were found on the majority of plants in a single field of oats, the seed for which came from North Dakota. Evidence pointed to control through seed treatment. The occurrence of what appears to be another bacterial disease of oat leaves was noted in several localities. The presence of a dry bacterial ooze was noticed in several cases), Arkansas (A bacterial blight is general in state, particularly in the north, injuring about 1%).

Other diseases

Powdery mildew, caused by Erysiphe graminis, was reported as common in parts of Washington and Oregon.

A root rot of a serious nature but of uncertain cause was common and destructive in parts of western Washington on oats as well as on wheat (See wheat).

A Rhizoctonia root rot was reported from Minnesota.

Red blade of oats, due to sub-normal temperatures during early growth, was reported from many places in Washington.

Scab, caused by Fusarium spp., was reported on oats by Professor Selby in Wayne and Summit Counties, Ohio, and by J. D. More from one field in South Dakota.

CORN

Smut caused by Ustilago zeae (Beck.) Ung.

Corn smut, which occurs all over the United States, was probably somewhat more prevalent than usual when the country as a whole is considered. In the western portion of the corn growing region, it was apparently of considerable more than normal importance. In this section of the country, from North Dakota south to Texas, and including Colorado, the disease was severe and is apparently increasing yearly in amount and becoming a very serious problem. In the western part of Nebraska, 50% of the stalks were affected, while in Colorado, the loss was seldom less than 10% in any individual field and many plantings showed as high as 50% reduction in yield because of smut. Counts made in a number of Colorado fields showed as high as 40-60% diseased plants. In North Dakota, the disease is reported by Bolley as being very prevalent on new lands indicating that the spores are either seed-borne or else wind-blown long distances.

In the remainder of the corn belt, the disease did much damage. In Ohio, Illinois, and southern Michigan, it was thought to be rather worse than the average. Two states report sweet corn as being injured more than field corn.

Another section of the United States where the disease is a serious problem but on a smaller scale is the Carolina-Georgia area. Here smut is

especially prevalent on the bottom lands of river valleys where good growth is secured and where little or no rotation of the crops is practiced. In South Carolina 20% of the crop was reported injured and 2% lost, while in Gerogia, the average loss for the state is estimated at 5%. Indications are that corn smut is perhaps a more serious factor in reducing corn yields than has generally been realized and deserves more attention than has been given it in the past.

Rust caused by Puccinia sorghi Schw.

Rust was reported from most of the states in the eastern half of the country. In general it occurred in about the usual amounts but in Pennsylvania, Kentucky and Arkansas it was thought to be somewhat less than usual. While indications are that in Wisconsin, Minnesota, Iowa and Nebraska it was somewhat more serious than the average.

This disease is co-extensive with the corn states, and has never been reported to the Survey from Montana, Wyoming, Colorado, New Mexico nor states west with the exception of California where it was slight locally in 1910. From a comparison of reports of former years the disease seems to be most important in the southeastern states, including Louisiana (sometimes severe), Arkansas, Missouri and Iowa.

The losses caused by rust are small because the disease usually develops late in the season when corn is approaching maturity, and when a reduction in the leaf area is not especially harmful. When late planted corn is severely attacked however, as is sometimes the case, the reduction in yield may be appreciable.

Both field and sweet varieties were reported affected.

Brown spot caused by Physoderma zeae-maydis Shaw.

Physoderma developed in the Mississippi Valley during the early part of June but was checked by dry weather which lasted until about the middle of July. This dry period, although unfavorable to the corn crop of the South, greatly inhibited the fungus and undoubtedly prevented much loss. After the middle of July rains were more frequent so that the disease made considerable progress and caused more or less damage.

Physoderma was reported as being the cause of the most important corn disease in Georgia where it was general over the state, but especially noticeable in the mountain valleys of north Georgia and the Coastal Plain area. In these regions many fields showed 100% infection and some fields showed from 5 to 20% of the stalks broken down as a result of weakening at the nodes. One small patch inRabun County was observed where the corn seemed to be entirely broken down and destroyed by Physoderma and the numerous attending saprophytes. It was estimated by Collaborator Berry that the crop was injured in half of the fields of the state and that an average loss of about 10% was sustained.

Berry reported the disease worst in the moist, rich, bottom lands. Heavy applications of nitrogenous fertilizers such as barnyard manure seemed to favor it. The lack of proper crop rotation on many of these bottom lands of the South affords excellent opportunity for the continued propagation of the parasite in the soil.

South Carolina, was well as Georgia, suffered considerable loss (estimated at 5%). The disease was apparently more severe in these two states than in any other part of the South although it was very common

in other sections, particularly in Mississippi, Louisiana, Arkansas, Alabama, and Tennessee. In the latter state the disease is said to be increasing and caused a loss of 100,000 bushels last year.

The accompanying map shows the distribution and severity of the disease in 1917 when a survey was made by the Plant Disease Survey and the Office of Cereal Investigations.

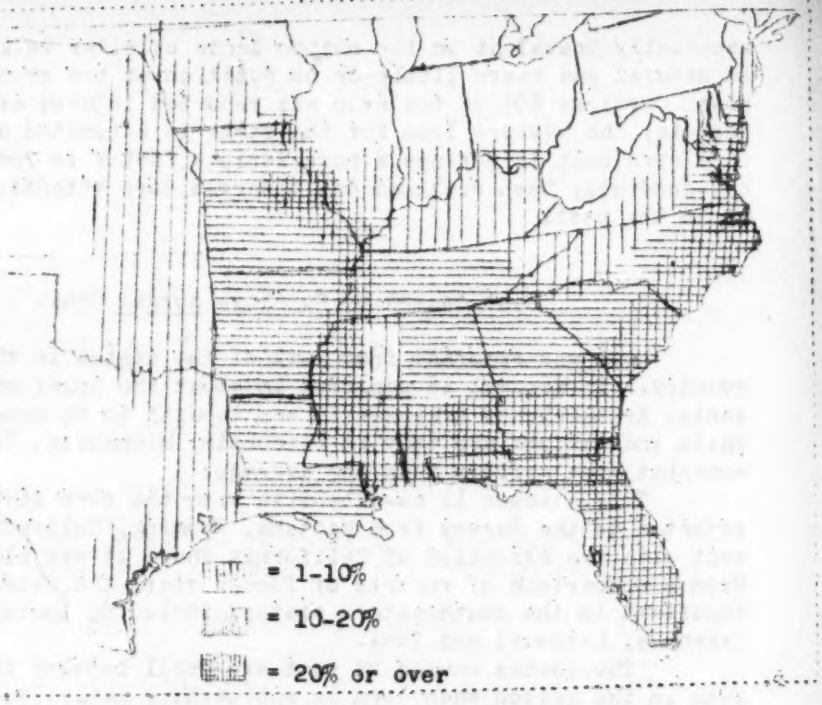

Fig. 7. Geographic range and relative abundance of Physoderma on corn, 1917.

Bacterium wilt caused by Bacterium stewartii. E. F. S..

Bacterial wilt was observed in a number of states in the eastern portion of the country causing slight losses locally to sweet corn. In most places where the disease was noticed, only a trace to 2 or 3% of the plants were affected but in some fields as high as 15% (Virginia) disease was evident. In general, the disease can be said to be relatively unimportant, but since it is capable of causing large losses it should be guarded against, especially in the large commercial sweet corn districts. Stowells Evergreen and Golden Bantam are mentioned as susceptible. It was observed on field corn in Tennessee by F. V. Rand, who made a large number of collections of the disease during the season in various states.

Root, stalk, and ear rots caused by Fusarium spp.

Fusaria were reported as causing root, stalk, and ear rots of corn in all of the corn states. At least one or more of these troubles were said to occur in all states east of, and including South Dakota, Nebraska, Kansas, Oklahoma, and Texas. Northern New England is excepted. It can not be said with certainty at this time in which states the troubles were worst.

A special survey was conducted by the Department of Agriculture in the summer of 1918. The outstanding results of this work have been given in an earlier number of this bulletin (Pl.Dis.Bul. 2:222-236, 1918.). It may be added that the greater amount of these troubles can be traced to the use of poor and infested seed for planting. It was also observed that where corn was planted continuously on the same land the rots were more

severe. Fields of low fertility or poor drainage or that were unfavorable for corn in other ways usually showed the highest amounts of disease.

The relation of these rots of the different parts of the plant and the identity of all the pathogenes concerned is being worked out by G. N. Hoffer at the Agricultural Experiment Station, Lafayette, Indiana.

Other diseases.

Leaf blight, caused by Helminthosporium sp., was reported from New Jersey (reported as inconspicum) as common, Florida (first report from state said to be severe), Louisiana (common), Mississippi (very slight locally), Pennsylvania (general, about as usual, 35% field corn affected, 65% infection in 5 acres of Golden Bantam sweet corn), Ohio (reported as graminium species).

Ear rot, caused by Diplodia sp., was reported from West Virginia (noticed in a number of fields but not thought to cause much loss), Ohio (reported from nine counties), and Washington (Spokane).

Root rot, caused by Bacillus sp., and similar to Burrills Illinois disease was reported by M. T. Cook as very severe in places in New Jersey.

Sclerotium rolfsii was found on one corn plant near Brownsville, Texas, by L. R. Hesler, May 7.

Rhizoctonia sp. was reported from Ohio and Washington.

Cladosporium was reported from Washington, occurring as a mold of the kernels.

Aspergillus sp. was reported from Texas causing mold of ear.

"Frenching" of corn, the cause of which is indefinite, was reported as general in southeastern Georgia. In this section of the state some individual fields were a total loss. First reported May 15. Said to be most severe when hot dry weather follows a wet season.

RICE

Blast caused by Piricularia grisea (Cke.) Sacc.

Blast was reported from Georgia, Florida, Porto Rico, Alabama, Mississippi, and Arkansas. In none of these states was the disease at all abundant and no cases of any particular damage are reported.

Other diseases.

Smut, caused by Tilletia horrida Tak., was reported as present, locally in Georgia, where it was observed August 20.

Green smut, caused by Ustilaginoidea virens (Cke.), was observed in traces, August 20, in Chatham County, Georgia.

Drought injury, caused considerable damage in the Arkansas rice growing region.

Blight, of a non-parasitic nature, was also reported as injuring 3% of the Arkansas rice crop. It was said to be general in the rice section. A similar trouble was said to be causing some damage in Mississippi and Porto Rico.

Leaf spot, caused by Cercospora oryzae Miy., was collected in the vicinity of San Juan by J. A. Stevenson.

SORGHUM

Head smut caused by Sphacelotheca reiliana (Kuhn) Cl.

Head smut was reported from Wisconsin, Minnesota, Kansas, Texas, and New Mexico. In all of these states it was of only slight importance, although in Texas it was said to be common and causing considerable loss.

Kernel smut caused by Sphacelotheca sorghi (Lk.) Cl.

Kernel smut was reported from Wisconsin, Nebraska, Kansas, Missouri, Arkansas, New Mexico, Colorado, and Washington. In these states it was apparently most abundant in Kansas, Nebraska, and Missouri. In the latter state 1% of the crop is reported damaged and it is thought that such varieties as Early and Red Amber are more susceptible than Amber, Kafir corn, and Milo Maize. In Kansas it was very common causing 5 to 8% loss. Some fields had as high as 40% smut. One specimen of Feterita, which in literature is said to be immune, was found with smut in Kansas.

Other diseases.

Blight, caused by Bacillus sorghi, Burr., was reported as common in Iowa, Missouri, Kansas, Arkansas, and New Mexico. It was also noted in Montana on August 1 and in Wisconsin.

Leaf spot, caused by Helminthosporium sp., was reported from the southwestern part of New York state on July 23.

Fusarium was reported on sorghum from Ratcliff, Arkansas, September 6.

Bud blight, cause not fully determined, was common in many Kansas fields according to L. E. Melchers.

Blight, cause undetermined, was reported on Sudan grass (Holcus sorghum var. sudanensis) in Texas, and a leaf spot and blight was found on the same host and on Johnson grass in Alabama.

BUCKWHEAT

Stem canker, cause undetermined, was found in Montana in a small field north of Columbus, destroying 2 to 3% of the plants.

Leaf spot, caused by Ramularia sp., was reported from Pennsylvania Huntingdon County, September 7.

Rhizoctonia sp., was reported from Washington.

DISEASES OF FORAGE CROPS

A. LEGUMES.

ALFALFA

Leaf spot caused by Pseudopeziza medicaginis (Lib.) Sacc.

Reports received from seventeen widely separated states indicate that leaf spot was general on the alfalfa crop but doing only a slight amount of damage. It appeared to be worst in Missouri where it was reported as very destructive over Cape Girardeau County. Tennessee reports 90% of the crop affected.

In Texas leaf spot often becomes so serious on susceptible varieties as to completely defoliate the plants. Of the varieties that have been under test there, the "Hairy Peruvian" has given the most satisfaction both because of its resistance to leaf spot and root knot and its hardiness to cool weather.

In general it was worst on the first crop.

Yellow leaf blotch caused by Pyrenopeziza medicaginis Fckl.

Reported from New York (found about Ithaca), Georgia (slight locally), Kansas (not common, but did damage in some local instances), Oklahoma (locally), Montana (common, but no damage), South Carolina (common), and Washington.

Anthracnose caused by Colletotrichum trifolii Bain.

Reported from New York (only one report, June 1, Long Island), Delaware (as usual 1/2%), South Carolina (common, 10% crop injury), Georgia (local, only small loss), Mississippi (local, slight loss), Ohio, and Oklahoma (local, no loss).

Crown wart caused by Urophlyctis alfalfae (U. Lagerh.) Magn.

Reported from Nevada (in west, very slight damage), and Oregon, Jackson and Josephine Counties (1-5% crop injured but not serious).

Root rot caused by Sclerotinia trifoliorum Erik.

Reported from Kentucky (general, 10% loss), Ohio, Oregon (very severe locally), South Carolina (15% loss in some fields), Tennessee (10% crop injury), Virginia (unusually prevalent, more than 50% of crop injured). The disease first appeared early in the spring (February in Tennessee to March 19 in Virginia) and occurred on clovers as well as alfalfa (See clover

page 155). As will be noticed this is a serious disease in some localities. It is interesting to note that it is reported only from a group of states in the central eastern part of the United States and from the extreme northwest. A summary of the records of occurrence of the disease in recent years also seems to show a similar geographical restriction.

Downy mildew caused by Peronospora trifoliorum De Bary.

Reported from Mississippi (slight loss locally), Oregon (general, very slight loss), Montana (common, but no damage), and Washington (very slight loss).

Bacterial blight caused by Bacterium medicaginis Sack.

Reported from Minnesota (general), Nevada (general), Washington, and California. In the latter state it was found by F. R. Jones in the Sacramento Valley and his report is believed to be the first for this disease from the state. In none of the states is bacterial blight said to have caused any damage in 1918.

Root rot caused by Ozonium omnivorum Shear.

Reported only from Texas and Oklahoma (slight locally). In general the disease was less common than usual on account of the extremely dry season. In Texas it was prevalent, injuring about 2% of the crop. It was found on practically every farm and on most soils. According to Taubenhaus the disease usually appears on second year alfalfa, killing large areas in spots. It is especially severe on land that has not been sub-soiled. Generally when the disease becomes serious in Texas the field is planted with sorghum.

Root rot caused by Rhizoctonia sp.

Reported from Iowa, Kansas, and Washington. In Kansas and Iowa one case only was reported and the loss apparently was not very great. In Washington the disease was severe locally.

Leaf spot caused by Cercospora medicabinis E. & E.

Reported only from New Jersey and Texas. Unimportant in both states.

Wilt caused by Sclerotinia libertiana Fckl.

Reported from state of Washington (three localities, severe to moderate.)

Other diseases.

Rust, names of fungi not given but one of the Uredinales was reported from Alabama and Texas. In Alabama a very severe attack was observed in a field near Auburn by G. L. Peltier. This is the first time he has seen it in the state.

At College Station, Texas, the following varieties of alfalfa showed variation in susceptibility to rusts according to Taubenhaus and Malley: Varieties most subject - Oasis, Baltic, India, Turkestan. Varieties least subject - Hairy and Smooth Peruvian. Medium resistant types - two types of Spanish, two types of Kansas, and Grimm.

Phoma sp., was collected on alfalfa in Kansas, April 29. It was injuring about 1% of the crop in a few local instances.

Dodder, caused by Cuscuta spp., was reported from Arkansas (not common), Texas (unimportant), and Georgia (local early in season in south Georgia).

Fusarium sp., was reported by Frandsen as causing a root rot in Churchill County, Nevada. The damage was inappreciable.

Thielavia basicola was reported locally in Massachusetts. Earliest report was May 16.

Stagnospora carpathica (sp.?) was reported from New Jersey.

A white spot was reported from New Jersey (of little or no importance) and Washington, and a white leaf trouble similar to that described by Crabill (Phytopath. 6: 91-93, 1916) and of uncertain cause was reported from Montana where affected plants occurred in areas of considerable size in many fields. In one field practically every leaf of each plant was completely etiolated.

Alkali injury was reported from the Rio Grande Valley, Texas, and from Yakima County, Washington.

Winter injury. As a result of a special inquiry made in New York, 43 replies were received from 34 counties. Injury was reported from 17 counties. The average crop injury for the 34 counties was 11.5%. Since, however, the counties that reported the highest losses are not the largest producing counties it is probable that 11.5% as a general average for the state is too high.

CLOVER

Leaf spot caused by Pseudopeziza trifolii (Pers.) Fckl.

This leaf spot was reported from New York, Delaware, Ohio, West Virginia, and Kentucky. It did not seem to be of much importance, although locally in West Virginia and Kentucky it was said to have caused considerable trouble. In New York, where it was first reported July 2, it was noticed that red clover seemed to be more affected than alsike or white clovers.

Anthracnose caused by Colletotrichum trifolii Bain.

Anthracnose was reported from Maine, New York, Delaware, South Carolina, and Ohio. The disease seemed to be of slight importance only in all states. In Ohio it was thought to be more prevalent than usual, but in the other states apparently about the same.

Rust caused by Uromyces trifolii (Hed.) Lev.

Reported from Vermont, New York, New Jersey, Delaware, West Virginia, North Carolina, Georgia, Ohio, Minnesota and Arkansas. In all these states the disease seemed to be common but for the most part of only slight importance. In North Carolina and Georgia however, some few local outbreaks proved rather damaging to the crop.

Dodder caused by Cucuta spp.

Only reports were from Delaware (less prevalent) and Arkansas (generally distributed).

Other diseases.

A stem blackening and leaf blight, said to be caused by Bacillus lathyri M. & T., was reported by Manns from Delaware as being common and injuring about 1% of the crop.

Phyllachora trifolii was reported from Vermont as unusually common and injuring 75% of the crop at least around Burlington.

Sooty spot, caused by Polythrincium trifolii Kze., was reported from Delaware as injuring about 1%.

Gloeosporium caulivorum was reported by Sheldon from Monongalia and Preston Counties, West Virginia, where it seemed to be general and causing some damage, especially to blossoms.

Erysiphe polygoni was reported from Oregon ("probably general") and Washington.

Winter injury. A special inquiry regarding the extent of winter injury (1917-1918) was made in New York. Injury was reported from 14 counties scattered rather widely about the state. The average of 43 reports from 34 counties gave a crop injury of 3%.

Stemphyllium or Macrosporium was reported from Arkansas (general).

Rhizoctonia root rot was reported from Minnesota (trace) on alsike clover, and from Washington on sweet clover.

Sclerotinia libertiana was reported from New Jersey (occasional), Delaware (50% injury in at least one field) and Washington (on sweet clover).

Alkali injury was reported from Yakima County, Washington on alfalfa, clover and sweet clover.

VETCH

Anthracnose, caused by Colletotrichum sp., was reported from Alabama.

Rust, caused by Uromyces pisi (Pers.) DeBary, was reported as occasionally occurring in Vermont.

Leaf spot, caused by Ascochyta sp., was reported once from the vicinity of New Haven, Connecticut, June 28.

B. GRASSES

MILLET (Panicum sp.)

Leaf spot, caused by Piricularia grisea, was found occurring locally in Minnesota.

Blight, apparently of bacterial cause, was noticed on three varieties of millet in Minnesota about August 17.

Downy mildew, caused by Sclerospora graminicola (Sacc.) Schr., was reported August 2 by L. H. Pammel from South Dakota. Pammel has reported this disease from Iowa frequently since 1909.

Smut, caused by Ustilago crameri, was reported on Italian millet from Nebraska.

TIMOTHY (Phleum pratense)

Rust, caused by Puccinia phlei-pratensis Eriks., was reported from New York (July 13), Pennsylvania (July 8), Ohio, Missouri and Montana.

Smut, caused by Ustilago striaeformis (West.)Niess., was collected in Iowa, Missouri and Washington.

Leaf blight, caused by Scolecotrichum graminis Fckl., was found severely damaging the leaves of plants in Montana.

A blade blight, bacterial in nature, was reported in Ohio.

A leaf blight, of undetermined cause, was found causing a great reduction in yield around Pomona, New York, June 27.

RED TOP (Agrostis alba)

Puccinia graminis was found on Agrostis alba at Oskaloosa, Iowa, June 19, forty feet from a hedge of infected barberries. None was found on the other supposedly susceptible grasses near by.

QUACK GRASS (Agropyron repens)

Stem rust, caused by Puccinia graminis, was reported on this host from Maine, New York, Illinois, Wisconsin, Minnesota and Nebraska. The following accounts of the relation of Agropyron to the cereals and the barberry from W. J. Morse from Maine and H. W. Anderson from Illinois are of interest.

Maine - "The relation between rust on barberry and on wheat and quack grass in a single location in Presque Isle was the subject of repeated observations by Dr. Folsom during the summer. Aecidiospores were being produced on the barberry about May 15 and in good amount on June 3. A wheat field across the road at the southeast was examined at various times

during the summer and no stem rust was observed till about harvest time when a small amount was found. This was spring wheat. Agropyron, between the road and the wheat and in the edge of the wheat field, became thoroughly infested with stem rust long before this. On July 12 stem rust could be found on the quack grass on the same side of the road as the barberry bushes for 180 feet to north and 105 feet to south."

Illinois (July 2) - "At Wheaton barberries were located on the edge of a garden and Agropyron repens about them was so heavily infected that the rust could be seen several yards and was in a dying condition. Along the edge of the garden A. repens extended for 50 yards to a lane at the other end of the garden. Across the lane was the wheat field. At the edge of this wheat field, next to the wheat, A. repens was heavily infected. There was absolutely no rust on the wheat. Across the road from the garden in another direction was an oat field. There was absolutely no infection on the oats, although A. repens along the roadside next to the field was heavily infected. This has been generally found to be the case in our observations in northern Illinois in the neighborhood of infected barberry. We have not yet found stem rust on wheat in northern Illinois, although I found it on rye in the neighborhood of Wheaton."

Ergot, caused by Claviceps purpurea, was collected in Minnesota and Nebraska.

Stem rust, caused by Puccinia graminis, was observed as very abundant on Agropyron tenerum near infected barberry bushes at Fort Collins, Colorado, Away from the barberries there was none on the grass and very little on wheat. What was reported as leaf rust was found on this host near Spooner, Wisconsin.

MEADOW GRASS (Poa sp.)

Puccinia poarum was reported from Minnesota.

Silver top of blue grass, caused by Sporotrichum sp., was observed in Iowa.

FESCUE GRASS (Festuca sp.)

Leaf spot, thought to be caused by Helminthosporium sp., was reported by Melhus from Iowa.

BROME GRASS (Bromus sp.)

Smut, caused by Ustilago bromivora, was reported by Heald and Dana from Washington.

Powdery mildew, caused by Erysiphe graminis, occurred at Pullman, Washington.

Leaf rust, cause not stated, was collected on B. ciliatus at Solon Springs, Wisconsin.

ITALIAN RYE GRASS (Lolium multiflorum)

Anthracnose, caused by Colletotrichum sp., was observed in Washington state, near Tacoma.

BOTTLE BRUSH GRASS (Hystrix sp.)

Leaf spot, caused by Phyllachora graminis, was collected in Chisago County, Minnesota.

CRAB GRASS (Digitaria)

Leaf spot, caused by Piricularia grisea, was reported as common but unimportant in a number of places in east Texas.

BERMUDA GRASS (Cynodon sp.)

Puccinia cynodontis De Lac was collected several times in Porto Rico.

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